cases, however, the loss of speech brought with it the loss of musical expression, though it was definitely ascertained that at least two of the five were musically inclined. Whether these differences depend on individual education, upon different locations of the affected mental centres, or upon the intensity of the affection, remains to be determined.

ELECTRICAL SCIENCE.

Electric Conductors for Alternating Currents.

ONE of the most practical and useful papers read before the last meeting of the British Association was one by Sir William Thomson, in which he calculated the distribution of a rapidly varying electric current in a conductor.

It is well known that an electric current which has reached a steady condition in a wire is uniformly distributed through its section, and the resistance of the wire varies inversely as the area. But with rapidly varying currents the case is different, and the difference may be understood from an analogy to liquid motion, due to Mr. Heaviside. In the first place, Professor Poynting has shown that the electrical energy which appears in a wire carrying a current is not conveyed directly through the wire from the dynamo or battery supplying it, but it is first conveyed to the medium surrounding the circuit, and then enters the wire at every point from the medium. According to Mr. Heaviside, the state of the case may be partially represented by a hollow tube in a tank of water. If we move the tube slowly in one direction, and if the tube be long in proportion to its diameter, then in a short time all of the particles of water in the tube will be moving with it, at the same velocity. This represents a steady current; and it partly illustrates Professor Poynting's idea, for the motion of the water is due to the friction of the tube at every point of the boundary, not to a pressure along the tube such as would be produced by a piston in it.

If, instead of giving a steady motion in one direction, we move the tube backward and forward rapidly, we will have the outer layer of water moving nearly as fast as the tube, the velocity decreasing as we proceed inward; and, finally, if we make the oscillations short enough and rapid enough, the inner layers will not move at all, only the particles near the outside taking part in the motion.

Now, this is exactly what happens in the case of an electric current which changes very rapidly. If the change is rapid enough, the current — corresponding to the velocity of the particles of water — will be mainly near the outer surface of the wire, and it might happen that there is no current at all at the axis. The effect of this is to increase the apparent resistance of the conductor, causing a greater loss from heating, and a greater fall of potential, than ordinary calculation would give.

Now, although these facts have been pretty well known since Maxwell's treatise on electricity and magnetism was published, yet very few people suspected that they would have any practical bearing on alternating systems of electrical distribution. Sir William Thomson, however, in calculating out some numerical examples, obtains results which show that in the alternating system as ordinarily used a considerable portion of the inside of the conductors does not carry any current at all, and is useless. For example: with the period of alternation used by the Westinghouse Company in the United States, in the neighborhood of eight thousand a minute, the current does not penetrate so much as one-eighth of an inch into the wire. The size of conductor used for distributing current for even a moderate number of lamps — say, a thousand lamps at a mean distance of a mile — is much beyond this limit of semi-diameter, in the case cited being more than half an inch in diameter. The result is a much greater loss by heating than is usually calculated, and a fall of potential that in some cases interferes with the brightness of the lamps. In order to make these effects a minimum, it would be necessary to use for conductors either thin, hollow tubes, or thin, flat strips of metal, and especially is this the case when a large number of lamps are to be supplied. The expense of the tubes would in all probability make their use impracticable; so that in future we may expect to see any extended alternating-current distribution either with copper strips as conductors, or with a number of comparatively small wires. It should be pointed out as an illustration of the value of a sound mathematical training in applied electricity, that the best form of conductor for any particular case of distribution, whether strips, a single wire, or a number of wires, can be calculated from obtainable data as to prices. It is the experience of the writer, however, that few electric plants are installed in a way to secure the greatest economy, and much money is wasted needlessly from neglecting to make the necessary calculations.

THE SUN-LAMP. — One of the most attractive of high-power electric lamps is that known in France, where it was invented, as the '*lampe soleil*.' It consists of a wedge of some refractory material, marble preferably, held between two carbon rods that are inclined to one another. This is set in a cavity in a marble block held in an iron frame. A very simple lamp of this kind can be made by boring a couple of holes in a block of marble so they are slightly inclined and approach within about a quarter of an inch at the bottom, and putting in two carbon rods. If this be supplied with an alternating current to form an arc between the carbons, the marble will be heated, and will give off a brilliant, mellow light of a golden tinge, very different from the piercing but rather disagreeable light of the ordinary arc-lamp. A very high candle-power can be obtained from it, and it is absolutely steady. The objections to its use arose from the facts that it was not certain to start up automatically when the current was turned on, and it required alternating currents instead of direct. This was some years ago, before alternating currents had been largely introduced. From the fact that a larger surface has to be heated than in the ordinary arc-lamp, and the surrounding material conducts away a considerable amount of heat, the lamp is not so economical as are arc-lamps. In the last few years alternating-current distribution has been developed, and now an English syndicate is being formed to introduce a modified sun-lamp, in which many of the objections of the old form have been removed. The lighting is now automatic and certain, and the lamp can be used either with continuous or alternating current generators. For lighting halls, galleries, etc., and in general for interior illumination, this modified lamp should have an extensive field.

THE ELECTRIC LIGHT VS. GAS IN FRANCE. — Messrs. Brun & Co., owners of a silk-manufactory at St. Clamond, give some particulars, in *Annales Télégraphiques*, as to the comparative cost of gas and electric lights, obtained from two years' experience in their works. The original lighting of the factory was by 540 gas-jets, consuming 20,000 francs' worth of gas annually. These were replaced by 600 incandescent lamps, — one-half Edison, the rest Swan, — the average life being 1,200 hours. The current is supplied by an Edison dynamo of 450 ampères and 100 volts. It has worked for 18 months at an average of 15 hours per day. Part of the factory works night and day, and some of the lamps work 3,600 hours a year, while others are only used for 600 hours. The following are the expenses: —

Cost of 90-horse-power engine, with fittings	32,000 francs.
Dynamo, conductors, lamps, etc	23,000 "
Total	55,000 francs.

The yearly cost is, —

10 per cent sinking fund	5,500 francs.
5 " " interest	2,750 "
Increase in coal-consumption	1,200 "
" " oil, etc	250 "
Renewal, 600 lamps	2,700 "
Total	12,400 francs.

The saving is 7,600 francs per annum. The item of labor is not included, as the force of mechanics was not increased on putting in the installation.

BOOK-REVIEWS.

The Land beyond the Forest. By E. GERARD. New York, Harper. 12°.

MRS. GERARD has collected her observations during a two-years' life in Transylvania in the present attractive volume, and greatly enhanced the value of her descriptions by adding to her own experiences information from other sources, which became

full of life in her mind, that is so deeply impressed by the wild beauty of this remote province, and by the strange admixture of races by which it is peopled. The authoress describes the Saxons, Roumanians, and gypsies very fully, while she gives only a passing glance to the Hungarians. It is probably because she became more intimately acquainted with the former, and studied their customs and beliefs more thoroughly, that she confines herself to the description of this part of Transylvanian life. The large amount of interesting and valuable ethnological information collected by the authoress deserves our full admiration. Customs and beliefs which have survived from the ancient days of paganism or from the superstitions of the middle ages offer a peculiar interest to the student of the history of civilization; and the present volume contains much that is worth a thorough study, and that will interest the thoughtful reader. The descriptions of the country and of its inhabitants are vivid, and made more impressive by numerous illustrations, which are the more welcome, as Transylvanian scenery is little known, and has not yet received much attention by artists.

Manual of Chemistry. By W. SIMON. 2d ed. Philadelphia, Lea Bros. & Co. 8°.

THIS manual is designed to be a guide to lectures and laboratory work for beginners in chemistry, and a text-book specially adapted for students of pharmacy and medicine. The contents are divided into seven parts. The first part treats of the fundamental properties of matter, extension or figure, divisibility, gravitation, and porosity. In the second are considered the fundamental principles of chemistry, including chemical divisibility, the laws of chemical combination, the determination of atomic weights, the decomposition of compounds, and some general remarks regarding elements. Non-metals and metals, with their combinations, are next discussed. Then follow analytical chemistry and the consideration of carbon compounds or organic chemistry, while the last part is devoted to physiological chemistry. As a help in laboratory-work, experiments are described which may be readily performed by students with a small amount of apparatus. Professor Simon, in common with other teachers, has often noticed how difficult it is for beginners to familiarize themselves with the variously shaded colors of chemicals and their re-actions; and, in order to remove this difficulty as far as possible, he has introduced into the manual seven plates, which contain fifty-six representations of the most important color-changes. The coloring is remarkably correct, and will undoubtedly do much to overcome the difficulty which these plates were designed to meet. The book is in other respects fairly well illustrated. The typography and general make-up of the book are excellent, and we have no doubt that it will meet the same favor which was accorded to the first edition.

PUBLISHERS' FALL ANNOUNCEMENTS.

Estes & Lauriat.

For young people: 'Zigzag Journeys in the Antipodes,' a volume which takes the reader to Siam, and tells him of the interesting animal-worship of the country; 'The Knockabout Club in the Antilles,' by F. A. Ober; and 'Hunting in the Jungle,' from 'Les Animaux Sauvages,' by Warren F. Kellogg. 'The Pioneers of the Alps: A Collection of Portraits of the Leading Guides of the Oberland, of the Valais, of Savoy, and of Piedmont,' by C. D. Cunningham and Captain Abney. 'Fingers and Fortune: A Guide-Book to Palmistry,' by Eveline M. Farwell. 'The Pocket Encyclopædia,' containing 1,206 columns, upwards of 25,000 references, and numerous plates (published by subscription only). Editions de Luxe of standard and fine art works now issuing or soon to be issued (to subscribers only): 'History of Greece and of the Greek People, from the Earliest Times to the Roman Conquest,' by Victor Duruy; and 'Birds in Nature,' by R. Bowdler Sharpe.

Thomas Nelson & Sons.

'David Livingstone, the Story of his Life and Travels,' with many illustrations; 'The Emperor of Germany,' William I.: A Life Sketch,' by Athol Mayhew, with 8 full-page illustrations by R. Caton Woodville; 'Little Arthur at the Zoo, and What he saw there — Birds,' by Mary Seymour; 'The Story of the Niger: A Record of Travel and Adventure from the Days of Mungo Park to the Present Time,' by Robert Richardson; 'India, Pictorial and Descriptive,' by the author of 'The Mediterranean,' illustrated with 112 fine engravings; 'The Nineteenth Century: A History,' by R. Mackenzie (new edition, revised and enlarged); in the Pen and Pencil Series, 'Irish Pictures, drawn with Pen and Pencil,' by Rev. Samuel Manning, LL.D., Rev. S. G. Green, D.D., and others; 'Great Authors, from Goldsmith to Wordsworth,' with biographies and copious selections from their writings; 'Great Authors, from Macaulay to Browning,' with biographies and copious selections from their writings.

Frederick A. Stokes & Brother.

'The Golden Age of Patents,' by Wallace Peck, a most amusing parody on Yankee inventiveness, filled with clever skits, well illustrated by various humorous artists; 'Oysters and Fish,' by Thomas J. Murrey, a most complete and important work on the subject, deemed by the author himself as one of his most valuable books, and containing over 150 recipes and much interesting information regarding shell-fish and fish of many kinds; 'Eight Songs of Horace,' edited by George E. Vincent, a remarkable novelty, which has received the most careful attention in every detail, being an attempt to reproduce with all possible exactness a Roman book of the classic period; 'Favorite Birds, and What the Poets sing of Them,' edited by Josephine Pollard; 'The Game of Chess,' an entirely new edition, based upon Staunton's great work, and containing all essential parts of it; in the Lives of the Presidents Series, 'Grover Cleveland,' by William O. Stoddard; 'Madonnas by Old Masters,' being as exact facsimiles of the originals as it is possible to make by any process resulting in a copper or steel plate (the publishers know of nothing of their general nature which copy the same paintings and can compare with these valuable plates).

Miscellaneous.

The ninth volume of 'Alden's Manifold Cyclopedia' (New York, J. B. Alden) is out. —— 'Pen and Ink: Papers on Subjects of More or Less Importance,' by Brander Matthews, will be issued shortly by Longmans, Green, & Co. It contains essays on Locker and Austin Dobson, on war songs and short stories, on the antiquity of jests, and on the ethics of plagiarism, and also the first serious paper yet written on the genesis and practice of the American game of poker. 'B.C. 1887' is the odd title of a volume of travels in British Columbia, by the authors of 'Three in Norway,' Messrs. Lees and Clutterbuck, to be issued this month by the same publishers. Although humorous in manner and full of anecdote, 'B.C. 1887' is an account of a serious expedition of two young Englishmen who came to America with a view to settling in the Dominion. —— D. Appleton & Co. will publish on or about Nov. 1 a new volume by Sir John Lubbock, entitled 'On the Senses, Instincts, and Intelligence of Animals, with Special Reference to Insects.' It will form Vol. LXIV. of the International Scientific Series. The same firm announces 'A Manual of Decorative Composition,' for designers, decorators, architects, and industrial artists, by Henri Mayeux, architect to the French Government, with nearly 300 illustrations; 'A Dictionary of Terms in Art,' elaborately illustrated; 'Nature and Man, — Essays Scientific and Philosophical,' by the late Dr. W. B. Carpenter, with an introductory memoir by J. E. Carpenter; and 'The Folk-Lore of Plants,' by T. F. Thiselton Dyer. —— Charles Scribner's Sons published last week 'Children's Stories of the Great Scientists,' brief biographies of sixteen of the world's great scientists, by Miss H. C. Wright, with 8 full-page portraits. —— Harper & Brothers have ready 'The Boy Travellers in Australasia,' by Col. Thomas W. Knox, a description of the isles of the Pacific; and 'Shoshone and other Western Wonders,' an account of sights and scenery worth seeing in the Far West, by Edwards Roberts, with an introduction by Charles Francis Adams. Messrs. Harper and Brothers announce that John Morley's English Men of Letters Series, which hitherto has been issued in thirty-six volumes, has now been compressed into a People's Edition of twelve volumes. —— Mayor Hewitt's more or less cheerful face adorns the first page of *Harper's Weekly* for Oct. 17. The supplement is devoted to a description, pictorial and otherwise, of 'The United States Coast and Geodetic Survey,' by Henry P. Wells. —— Houghton, Mifflin, & Co.